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Species composition and zoogeography of the invertebrate fauna at the lower reaches of the Lajta River

by
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Abstract: The invertebrate fauna of the lower Lajta River is discussed, based on records of several important groups of freshwater invertebrate macrofauna. The faunal composition resembles that of the Danube and is unique for the lowland tributaries of the Kisalföld plain. Throughout the lower reaches of the Lajta, an extensive, longitudinal zonation was illustrated. The former situation of the watersheds and the upper Pleistocene origin of this river is still indicated in the present-day faunal composition.
Key words: Porifera, Bryozoa, Hirudinea, Bivalvia, Gastropoda, Crustacea, distribution, Lajta

Introduction

Since 1987 the species of several important taxonomical groups have been intensively studied by the author. The results are presented for 47 species, comparing their occurrence to the general distribution in other lowland tributaries of the Danube.

The Lajta is one of the larger tributaries of the middle reach of the Danube. Similarly to the Danube, the Lajta flows eastwards passing the Vienna and the Kisalföld plains. The middle and lower reaches flow through the lowlands, and the mainstream has a higher water current, compared to the neighbouring Morava (March), Rába (Raab) and Rábca (Rabnitz) rivers. The river originates in the eastern Alps. There are no important tributaries along the lower reach of this river. Here the Lajta enters the Pannonian plain, which is characterized by a warm and dry summer climate (Koncek 1965). The floodplain of the middle reach is wooded and has a large number of dead arms, which are connected with the mainstream during flood periods. In the Kisalföld plain, the Lajta is divided up into several river beds and flows into the Danube (Mosoni-Duna) near to the Szigetköz island (Fig. 1). This part of the Hungarian plain is the most downstream situated basin for the accumulation of alpine gravels (Fink 1966). The Lajta has a freshwater fauna, which is derived from two geographical regions.

Palaeogeography of the Kisalföld

The Danube is an example of a river valley of inhomogeneous origin (Orghidan 1966). Since the regression of the former Parathetys sea, the Danube has flowed through the Kisalföld, deluging the brackish lakes and depositing fluvial sediments (Fink 1966). This process continued during Pleistocene, helped by tectonic depressions in the Hungarian plains (Szádeczky-Kardoss 1938). As a result water flow in the Danube increased, and the current shifted in a northerly direc-

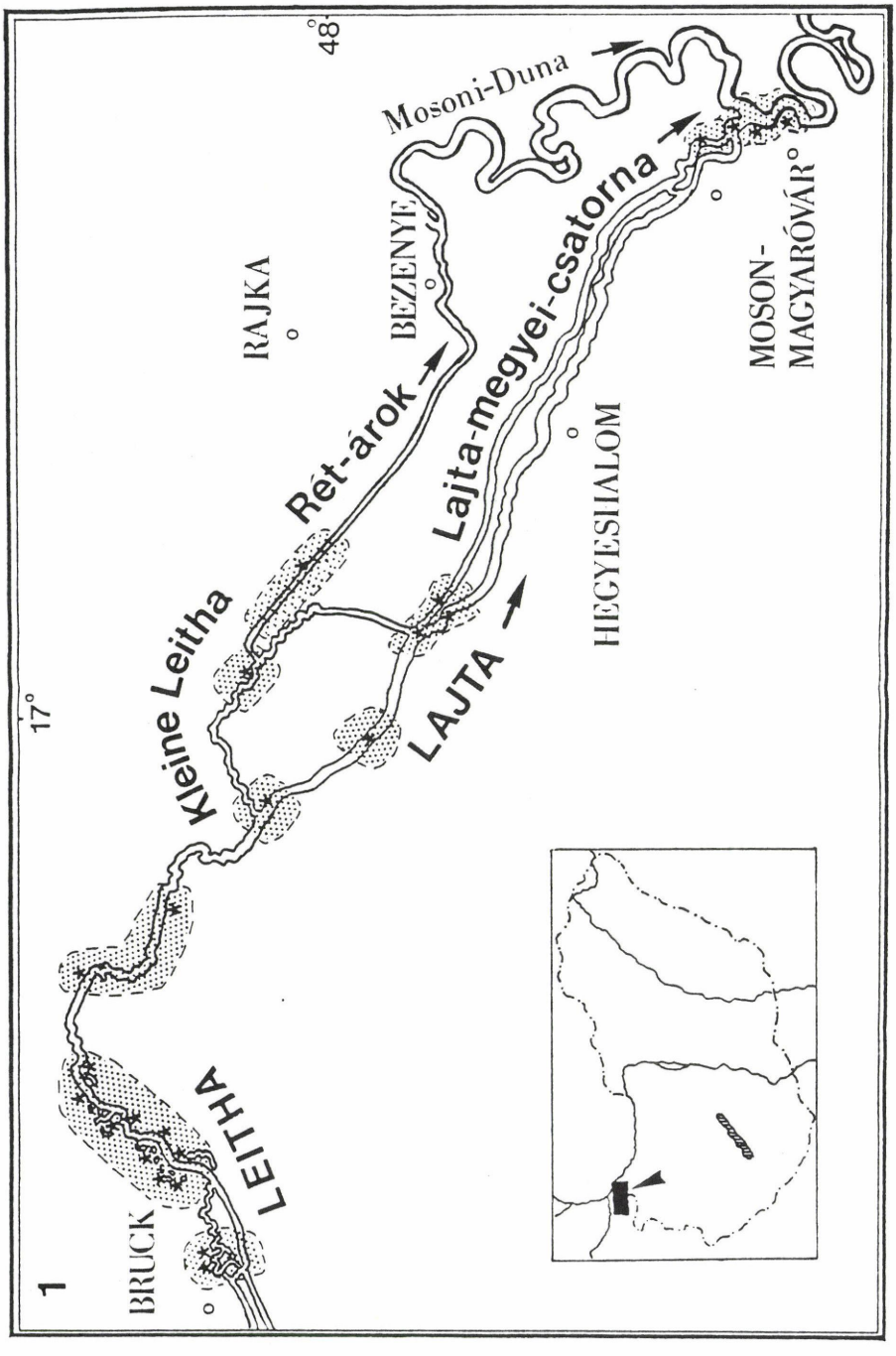


Fig. 1. The Lajta river with the studied area (dotted surface) and the stations (stars) of qualitative collections

tion. The river entered and widened several narrow valleys, e. g. the Porta Hungarica and the Duna kanyar, which were, up till the end of Pliocene, used only by its tributaries, the Morava, Hron and Ipoly. Additionally the basin of the Lake Fertő was originally formed by a secondary branch of the Danube (Szádeczky-Kardoss 1938).

During Pleistocene glaciations, the freshwater fauna of the upper Danube was strongly influenced by environmental changes and, consequently, a special faunal composition formed. Several species of the Danubian fauna were able to survive periods of glaciation. They all tolerate low water temperatures, high water current and are well adapted to the conditions of the rhithron (Balon 1968). In contrast to the upper Danube, the rivers of the middle and lower Danube basin had served as a refuge for the fauna of the potamon. The most recent faunal borders were established since the Würm glaciation.

From both geomorphological and zoogeographical point of view, the Lajta is the most important connecting link between the upper and middle Danube basin (Szádeczky-Kardoss 1937). Regarding the changes of the flowing direction, the geomorphological history of the lower Lajta is easy to understand. The middle reach follows the northern slope of the Leitha mountains in a north-easterly direction. At Hollern, the river bends off to the southeast. This point, where the Vienna and the Kisalföld plains meet, is the so-called gate of Bruck or the Porta Austriaca. Here was a former watershed. Originally, the Palaeo-Danube entered the Kisalföld, using the lower reach of the present-day Lajta. After the Paleo-Danube shifted its main stream to north, using the Porta Hungarica to break through to the Carpathian mountains, the Palaeo-Lajta extended its lower reach into the former Danubian river bed. Three different situations of the watershed can be distinguished (Fig. 2).

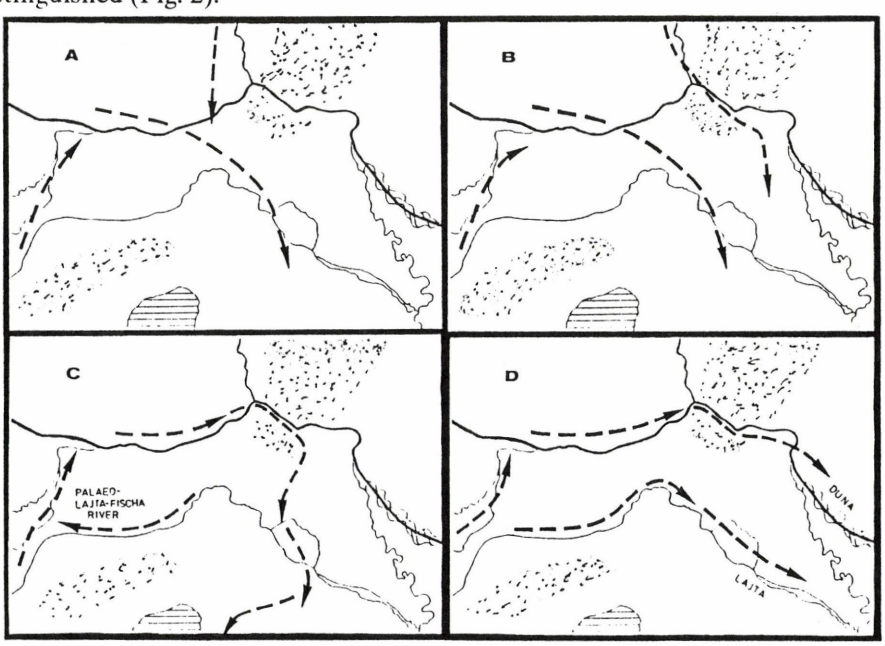


Fig. 2. Changes of watersheds and the direction of the rivers between the Vienna and Kisalföld plain.
A – Pliocene, B – Upper Pliocene and lower Pleistocene,
C – Middle Pleistocene, D – Upper Pleistocene and present-day situation

I. During the upper Pliocene, the Palaeo-Danube flowed into southeasterly direction, using the present-day catchment area of the lower Lajta. The upper Palaeo-Lajta only was a small tributary of the Vienna plain (Figs 2 A,B).

II. In the lower Pleistocene (Günz/Mindel glacial), the Palaeo-Danube occupied the narrow valley of the Porta Hungarica (Fig. 2C). A watershed was formed at the place of the present-day gate of Bruck. Originally, the middle reach of the Lajta between Rohrau and Götzendorf flowed into westerly direction (Palaeo-Leitha-Fischa-river on Fig. 2C). At last, it changed the direction of stream erosion during the middle Pleistocene.

III. The course of the Lajta was created during the upper Pleistocene, since the Danube shifted its mainstream into a northerly direction. At the same place, a stream erosion from the Vienna into the Kisalföld plain generally started, because of tectonic depressions of the erosion base (Fig. 2D). On the other hand, the accumulation of alpine gravels shifted the tributaries into a downstream direction. Simultaneously, the course of the present-day Lajta changed, because of river capture. It originated from the Pleistocene Palaeo-Danube and Palaeo-Leitha-Fischa river, which mainly belong to the zoogeographical region of the upper Danube basin.

Although the fauna of the upper Danube were radically influenced by the alpine glaciations, the former connections between the Palaeo-Lajta and Palaeo-Danube are still reflected in the present-day faunal composition.

Material and methods

The Lajta was investigated during periods of low water level in the late summer or autumn. The author collected qualitatively with a handnet (mesh size of 1 mm). Samples were preserved in 70% Ethylalcohol. After examination, samples were transferred to the Zoological Department of the Hungarian Natural History Museum in Budapest. Lists of localities were added for all species, (A) indicates all localities in the Austrian reach and (H) in the Hungarian reach of the Lajta.

Results

The recent fauna of the lower Lajta

Bivalvia

Thirteen species of freshwater mussels were recorded in the lower reach of the Lajta. The Sphaeriidae family is well represented, including several members characteristical of potamon rivers. In contrast, the Unionidae family is nearly extinct due to water pollution and the channelization of the formerly meandering mainstream.

Family Sphaeriidae

Several forms of the *Sphaerium corneum* group have been identified, but their taxonomical status remains unclear. Three forms, often labeled or characterized as subspecies, are more likely closely related species. All taxa were found in rivers of the Kisalföld, where they appear sympatrically in the lower reach of the river Rábca at Hanságliget near Bősárkány.

Only the typical form *Sphaerium corneum* (Linnaeus, 1758) is distributed widely in the western palaearctic region. It has no special autecological preferences. This species tolerates organic pollution and is very abundant in different types of

running water. Typically this mussels is found in gravel, sand or stone habitat in the rivers and streams of the plains (Zilch & Jaeckel 1962).

Sphaerium scaldianum (Normand, 1844) has a thick shell and prefers lowland-rivers with a moderate current velocity. It is common in sandy sediments. It is distributed throughout the continental inland waters of east- and central Europe.

The third and most interesting taxon is *Sphaerium nucleus* (Studer, 1820), which is thin-shelled. The external side of the shell is interrupted by greyish, irregular growth lines. *S. nucleus* differs from the other taxa by its habitat preference and ecology. It prefers the temporarily flooded ponds of deadwater reaches and old river beds, which are poor in oxygen and filled up with organic matter. It is also abundant in the submerged vegetation zone along the banks of slowly running rivers, e. g. the Mosoni-Duna.

In the Lajta, Bivalvia of the genus *Sphaerium* are less common than in other large Danubian tributaries of the Kisalföld. Only a few specimens were screened from muddy bottom. They belong to the next two of the characterised species.

Sphaerium nucleus (Studer, 1820)

Locality: Rohrau, in a secondary branch 14. 5. 1991 (A)

S. nucleus was collected from a secondary branch near Rohrau, where it lives sympatrically with *Musculium lacustre* (O. F. Müller, 1774), *Pisidium subtruncatum* Malm, 1855, and *Pisidium obtusale* (Lamarck, 1818).

Sphaerium corneum (Linnaeus, 1758)

Localities: Zurndorf (Zurány) 23. 6. 1991 (A), Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H).

S. corneum (Fig. 8) was rarely found in the fast flowing mainstream. It was washed from small accumulations of sand found between stones on the bank.

Musculium lacustre (O. F. Müller, 1774)

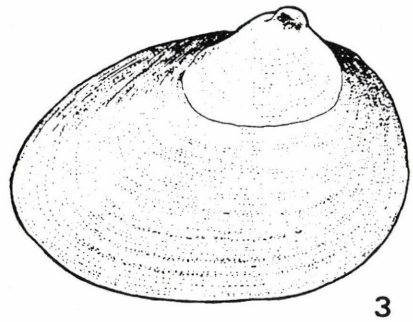
Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Rohrau, in a secondary branch 14. 5. 1991 (A).

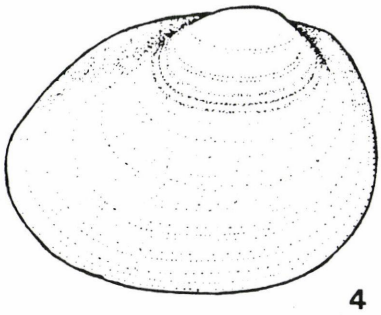
M. lacustre (Fig. 7) is a characteristic member of the fauna of small, temporary flood ponds, which occur in the floodplain of lowland rivers (Zilch & Jaeckel 1962, Falkner 1989, Nyilas & Sümegi 1991). Individuals were collected in high abundance from swampy areas of secondary branches.

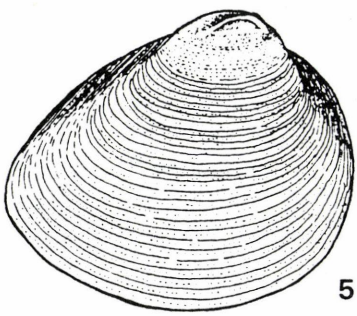
Pisidium amnicum (O. F. Müller, 1774)

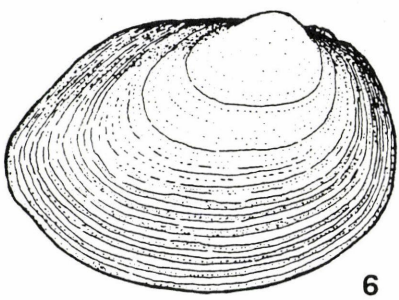
Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta at the confluence into the Mosoni-Duna 6. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H).

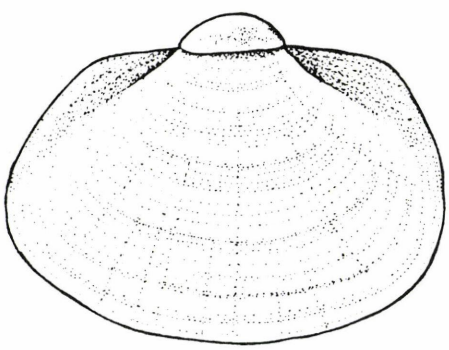
P. amnicum (Fig. 6) is mainly found in the potamon of rivers and streams of the lowlands. Its distribution includes the Palaearctic region (Zilch & Jaeckel 1962). This rheophilic species prefers the gravelly or sandy bottom of calcareous running waters, which are rich in oxygen. Many populations have become extinct because of water pollution. *P. amnicum* is no longer found in the upper and middle reaches of the Lajta. The fossil record shows that, originally, *P. amnicum* settled as far upstream as Rohrau. Living populations exist only in the Kisalföld. Compared to the present, *P. amnicum* was more common during Pleistocene (Szádeczky-Kardoss 1938). This species was as common in the fast flowing Danubian mainstream as *Theodoxus tranversalis* (C. Pfeiffer, 1828). It is a leading fossil in fluvial gravels from the pleistocene era. Some rivers with living populations are listed below. Large specimens were collected in high numbers from the Mosoni-Duna and from the main course downstream of Budapest at Dunaföldvár. A few











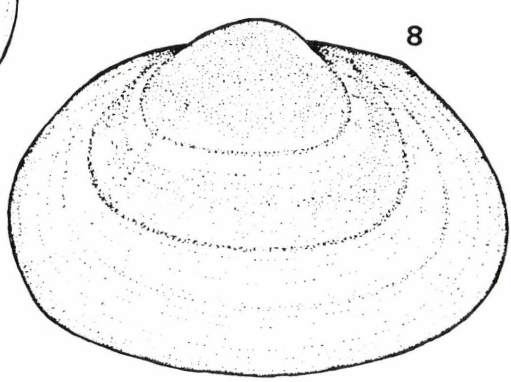


Fig. 3. *Pisidium henslowanum*, Lajta-megyei-csatorna
Fig. 4. *Pisidium milium*, Mosoni-Duna at Mosonmagyaróvár
Fig. 5. *Pisidium supinum*, Lajta-megyei-csatorna
Fig. 6. *Pisidium amnicum*, Lajta-megyei-csatorna
Fig. 7. *Musculium lacustre*, Mosoni-Duna at Mosonmagyaróvár
Fig. 8. *Sphaerium corneum*, Mosoni-Duna at Mosonmagyaróvár

specimens, washed from gravel, were found in the middle reach of the river Zala near Kustány.

Pisidium supinum A. Schmidt, 1851

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A).

This rheophilic species (Fig. 5) inhabits the sandy bottom of lowland rivers. It is a characteristic member of the potamon fauna and is strongly restricted to the Danube itself and lower courses of large tributaries (Pintér, Richnovszky & Szigethy 1979). *P. supinum* is also found in Lake Balaton and in the Morava river basin. In the Lajta, this species occurs only in the Kisalföld and does not occur in the middle reach as far upstream as Gattendorf.

Pisidium henslowanum (Sheppard, 1823)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) near Deutsch-Jahrndorf 30. 7. 1991 (A).

The distribution pattern of *P. henslowanum* (Fig. 3) is similar to that of *P. supinum*. The species does not reach the narrow valley between Hollern and Deutsch-Hasslau. It was frequently collected in the secondary branches of the Lajta in the Kisalföld, where faunal exchange with the Danube is possible. *P. henslowanum* is a member of the potamon biocoenosis, but it is not as rheophilic as *P. amnicum* and *P. supinum*. Therefore it also appears in the Rét-árok, where it prefers the muddy river-bed and a low water current.

Pisidium nitidum Jenyns, 1832

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) near Deutsch-Jahrndorf 30. 7. 1991 (A).

P. nitidum (Fig. 4) lives in lowland-rivers and lakes with sandy or muddy sediments (Falkner 1989). This stagnophilic mussel was found in mud samples from the bank. In the Lajta, the species appears in the lower reach and is recently restricted to the Kisalföld.

Pisidium subtruncatum Malm, 1855

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta at the confluence into the Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 6. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) near Deutsch-Jahrndorf 30. 7. 1991 (A); Zurndorf (Zurany) 23. 6. 1991 (A); Rohrau, in a secondary branch 14. 5. 1991 (A); Bruck, in a secondary branch 16. 7. 1991 (A).

P. subtruncatum is distributed all over Europe. It appers in all types of running waters of the rhithron and potamon. The species prefers muddy bottom (Zilch & Jaeckel 1962, Falkner 1989). It is by far the most abundant of the *Pisidium* species in the Lajta. It was screened in high abundance from several slowly-running, secondary branches and was collected most frequently from the sandy river bed of the main stream. It is widely distributed throughout the whole floodplain. Therefore it is often the only member of this genus found in the middle reach around Bruck.

Pisidium personatum Malm, 1855

Localities: Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) 30. 7. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A).

This species is generalist in its habitat preference. It also colonizes springs (Zilch & Jaeckel 1962). *P. personatum* was infrequently found in the lower Lajta.

Pisidium casertanum (Poli, 1791)

Localities: Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A).

P. casertanum is present in abundance in all types of permanent waters. In the Lajta, it was collected from a few localities of the Kisalföld.

Pisidium obtusale (Lamarck, 1818)

Localities: Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rohrau, in a secondary branch 14. 5. 1991 (A).

The mussel lives mainly in swampy ponds and is widely spread throughout Central Europe (Zilch & Jaeckel 1962). It was rarely found in secondary branches of the Lajta.

Family Unionidae

Anodonta anatina (Linnaeus, 1758)

Localities: Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 1989 and 1991 (A/H); Rét-árok (Leithakanal) 30. 7. 1991 (A/H); Rohrau, in a secondary branch 2. 6. 1990, 9. 1991 (A).

This species is the most abundant taxon of the genus *Anodonta*. It is distributed throughout the western Palaearctic region except the Mediterranean tributaries, where a sibling species occurs (Kinzelbach 1989). It was often confused with *A. cygnea* (Linnaeus, 1758), which prefers the more stagnant waters of the lowlands. For a long time, the two species were not distinguished correctly or considered under the collective name *Anodonta cygnea* (Haas 1969). Unlike *A. cygnea*, the euryoecius *A. anatina* settles in different types of running and stagnant waters of the lowlands. This species also tolerates moderate level of water pollution and lives entrenched in sand, mud or gravel bottoms. It is very abundant in the floodplains of all the rivers of the Kisalföld and also lives in lowland streams, e. g. Cúhai Bakony-ér and Russbach. In the Lajta, *A. anatina* was rarely found in large secondary branches near the castle of Rohrau, which are recently used as a fishery. Moreover this species was recorded frequently from the large branches in the Kisalföld. It is the only member of the family Unionidae, which still lives in the river Lajta.

Frank (1984) alleged that *A. cygnea* occurs in the Lajta-megyei-csatorna. The published data are based on a confusion with *A. anatina.*

Unio crassus cytherea (Küster, 1846)

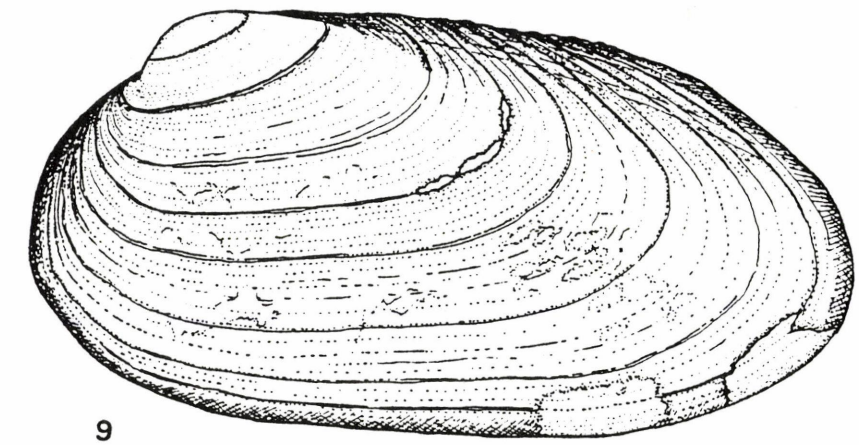
Localities: Rohrau, subfossil from sandy sediments of a secondary branch 1991 (A); Nickelsdorf (Miklóshalma) subrecent shells 1987 (A/H); Mosonmagyaróvár (Ungarisch Altenburg), subrecent shells along the gravelly banks 9. 1991 (H).

The distribution of *Unio crassus* includes central and eastern Europe, Asia Minor, and Syria. The species is absent from the western Mediterranean region, the Iberian Peninsula, and the British Isles. It prefers running waters and the littoral zone of large lakes, but is sentitive to water pollution (Haas 1969, Modell 1941, Reischütz & Sackl 1991).

Unio crassus shows an extensive geographical specialization. A large number of subspecies can be distinguished. They originate from the Pliocene and are very important for the documentation of former connections between different river basins. Pleistocene changes of the watersheds can be demonstrated with the persistence of distribution patterns of *Unio crassus* subspecies. Especially the former connection of the upper Danubian river basin with adjacent water systems (Rhine, Rhone) had been investigated using *U. crassus* since the beginning of this century (Kobelt 1908, Haas & Schwarz 1913, Zwiesele 1914).

The Danube and its tributaries belong to the oldest river basins in central Europe. According to their polygenetic origin, they are inhabited by several subspecies of *Unio crassus*. Some authors have alleged that *U. crassus cytherea* is the only subspecies in all Pontocaspian tributaries (Modell 1924). Actually, it is the only faunal member of the upper Danube, which was strongly formed by the Pleistocene glaciations. Its eastern distribution is bordered by the Kisalföld. Here *U. crassus cytherea* meets with another subspecies, which have originated in the lowland tributaries of the Danube. Such prominent faunal border have been documented for a number of freshwater organisms, e. g. the semiaquatic leeches. This border marks the general meeting point of freshwater fauna from the upper Danube with those from the middle Danube.

Subrecent and subfossil shells of *U. crassus cytherea* (Figs 9-10) were collected from several localities in the lower course of the Lajta. The mussel is extinct in areas due to water pollution, but small populations still exist in streams around Leithaprodersdorf. This proves that the fauna of the Lajta originated from the upper Danube rather than from the lowland rivers of the Kisalföld.



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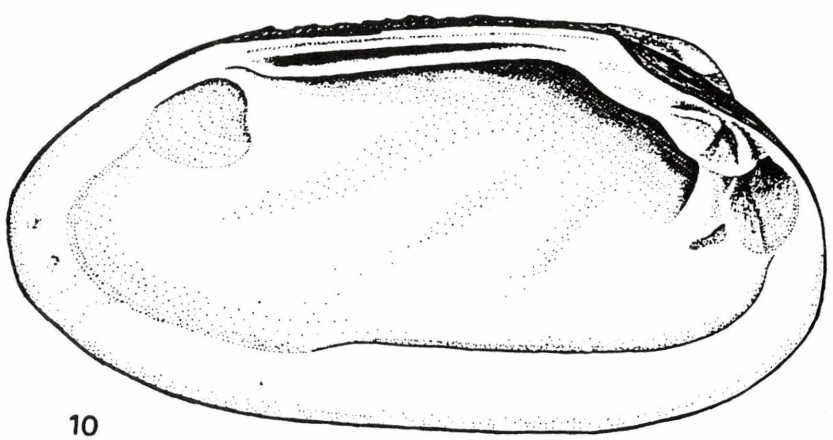

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Figs 9-10. *Unio crassus cytherea*, Lajta at Rohrau, subfossil

Gastropoda

Ten species, which are described below, belong to the subclass Prosobranchia. The Basommatophora are not considered in this paper. Although the composition of prosobranche fauna have changed since the regulation of the river, most of the species still exist in the region of Mosonmagyaróvár, where the Lajta flows into the Mosoni-Duna. The dominant families are Neritidae in the mainstream and Bithyniidae or Viviparidae in the large secondary branches.

Family Neritidae

Theodoxus danubialis (C. Pfeiffer, 1828)

Localities: Mosoni-Duna near Dunaszeg 23. 10. 1990 (H); Lajta near the confluence with the Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 6. 9. 1991 (H); Mosonmagyaróvár 3. 4. 1990 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Nickelsdorf (Miklóshalma) 23. 6. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); Hollern, 1,5 km downstream of the village 26. 10. 1990 (A); Rohrau, subfossil from sandy sediments 1991 (A).

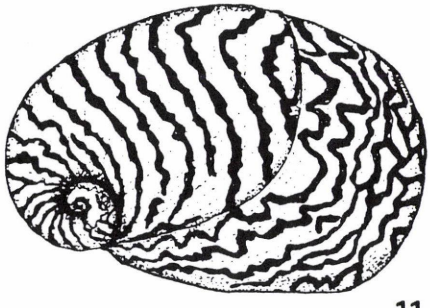
T. danubialis (Figs 11-15) originates from the Pontosarmatian basin (Zilch & Jaeckel 1962). It is the most abundant species of Neritidae in the middle and lower Danube. Its distribution includes not only the tributaries of the Black Sea, but the adjacent river systems, as well, which were formerly connected with the Aegeopotamos river basin during Pliocene or Pleistocene, e. g. the Axios or the Po river basin. Its fossil record is already documented for the Rhine river, where a faunal exchange took place during the Pleistocene situation of the watersheds (Kinzelbach 1985). Along the upper Danube, *T. danubialis* has a disjunct distribution (Leuchs & Tittizer 1989), whereas it generally appears in the middle reaches of the Danube and is completely absent from the Tisza river basin (Soós 1943, Pintér *et al.* 1979).

This species is typical of the fauna of fast flowing reaches of the potamon and prefers a gravel or hard bottom. A unique feature that it settles in large and deep deadwater lakes, which are rich in oxygen (Kühwörther Wasser near Schönau, Nesemann). Its occurrence in the Kisalföld is restricted to the Danubian floodplain and small stretches near to the mouths of tributaries. The only river, which is inhabited by *T. danubialis* throughout the whole lower course, is the Lajta. This species is distributed in the mainstream as far up as Hollern. In the more slowly running branches, *Bithynia tentaculata* (Linnaeus, 1758) is more abundant than *T. danubialis*. Only in the Lajta-megyei-csatorna, which has a moderate water current, are both species present in high abundance. The rheophilic *T. danubialis* belongs to the most abundant makrozoobenthos and settles in all parts of the river bed. Its range extends with short interruptions throughout the Mosoni-Duna.

Theodoxus tranversalis (C. Pfeiffer, 1828)

Locality: Rohrau, subfossil from sandy sediments 1991 (A).

This species also originates from the Pontosarmatian basin, but was originally distributed in the upper reach too (Zilch & Jaeckel 1962). Details of the habitat preferences of *T. transversalis* are not known. This species is more rheophilic than *T. danubialis* and is sensitive to water pollution (Falkner & Müller 1983). *T. transversalis* was thought to be almost extinct from the Danube. Today, relict populations exist only in the German section of the Danube (Peters 1989, Leuchs & Tittizer 1989). During intergacial periods *T. transversalis* appeared abundantly. The subfossil and fossil shells are frequently discovered in Danubian sediments as well as in some of its tributaries (Szádeczky-Kardoss 1938, Frank 1984).



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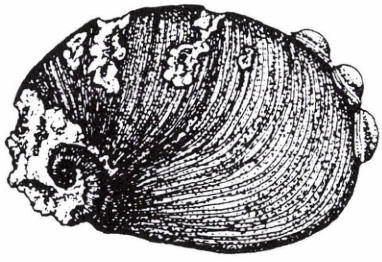

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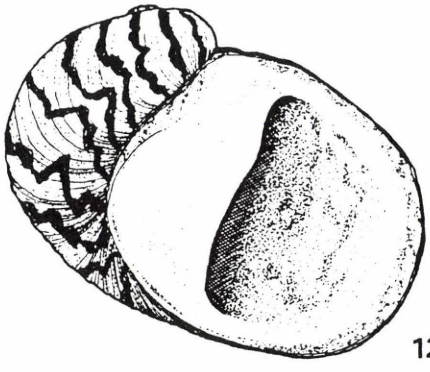

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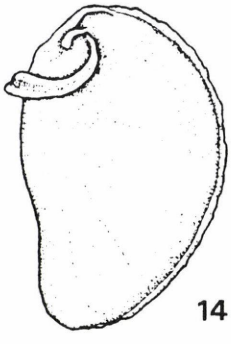

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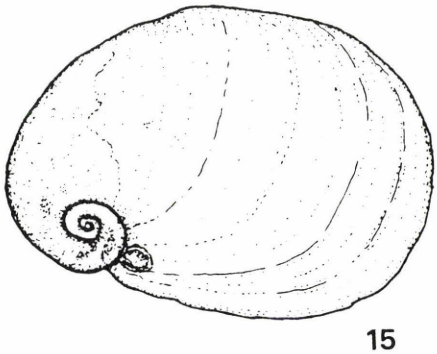

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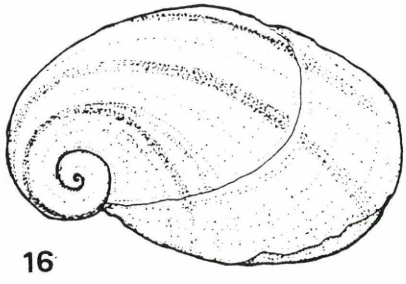

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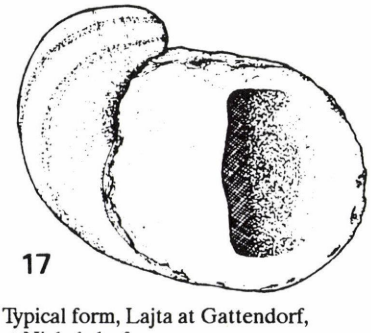

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Figs 11-15. *Theodoxus danubialis*, Figs 11-12 = Typical form, Lajta at Gattendorf,
Fig. 13 = Black form, Lajta at Nickelsdorf,
Fig. 14 = Operculum, Fig. 15 = Yellow form without stripes, Lajta-megyei-csatorna
Figs 16-17. *Theodoxus transversialis*, Lajta at Rohrau, subfossil

T. transversalis (Figs 16-17) does not live in the Lajta any more. The species was exhumed from sandy sediments and became extinct before the end of the 19th century. Water pollution and river channelization seems to be responsible for the disappearance.

Family Thiaridae

Microcolpia acicularis (Férussac, 1823)

Localities: Lajta near the confluence with the Mosoni-Duna 6. 9. 1991 (H); Zurndorf (Zurány) subrecent shells 23. 6. 1991 (A); Gattendorf (Lajtakáta) subrecent shells 30. 6. 1991 (A); Bruck, subrecent shells in the deadwater reaches 16. 7. 1991 (A); Rohrau, subfossil from sandy sediments (A).

Living specimens were found near Mosonmagyaróvár (Fig. 18). The former distribution area included the lower and middle reaches of the Lajta. *M. acicularis* is a pontosarmatian prosobranche snail. This species is restricted to large rivers along the Pannonian reach of the Danube (Soós 1943, Pintér *et al.* 1979). It does not enter the upper Danube basin as far upstream as Vienna (Zilch & Jaeckel 1962). *M. acicularis* was able to reach the Bavarian Danube for several times during interglacial periods. Its uppermost distribution is recently bordered at the Vienna plain and lower reaches of the Lajta and Rába rivers.

Esperiana esperi (Férussac, 1823)

Locality: Mosoni-Duna near Dunaszeg 23. 10. 1990 (H).

In contrast to *M. acicularis*, this species was not able to surmount the narrow valley of the Porta Hungarica (Falkner 1989). Its distribution range is bordered by the Kisalföld plain. Originally, *E. esperi* (Fig. 19) settled the lower reaches of the Lajta as far upstream as Nickelsdorf (Frank 1984). Here the species became extinct because of water pollution. Consequently, the uppermost record in the Danube basin is the Mosoni-Duna. *E. esperi* lives abundantly in the main stream of the Hungarian Danube.

Family Bithyniidae

Bithynia tentaculata (Linnaeus, 1758)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta near the confluence with the Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 6. 9. 1991 (H); Rét-árok 30. 7. 1991 (A/H); Lajta-megyei-csatorna near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rohrau 14. 5. 1991 (A); Rohrau, in secondary branches 14. 5. 1991 (A).

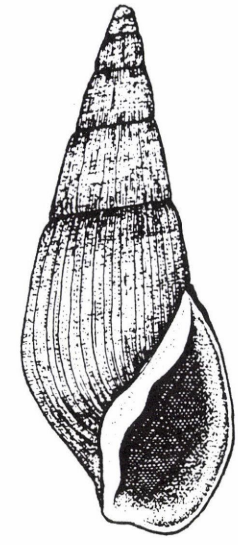
B. tentaculata (Fig. 20) is widely distributed and very abundant in European lowland rivers. It is generalist in its habitat preferences and settles all types of running and stagnant waters (Zilch & Jaeckel 1962).

Family Hydrobiidae

Lithoglyphus naticoides (C. Pfeiffer, 1828)

Localities: Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Rohrau, subfossil shells from sandy sediments 1991 (A).

This prosobranche snail (Fig. 23) is of pontocaspian origin and a typical member of the mud fauna of slowly running lowland rivers (Botos *et al.* 1990). In the Lajta, *L. naticoides* is no longer found in the middle reaches. The subfossil record shows that, originally, this species settled as far upstream as Bruck (Clessin 1888, Frank 1984). The populations of the Lajta became extinct because of the channelization.



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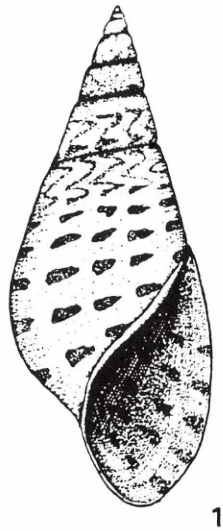

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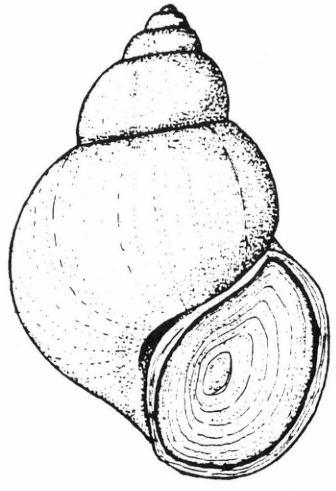

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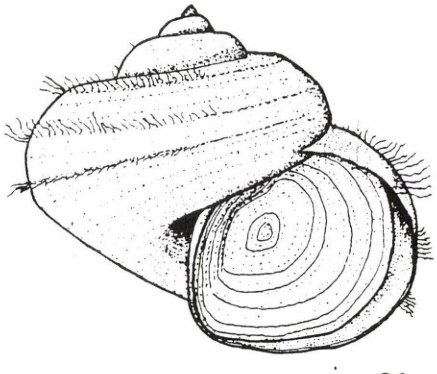

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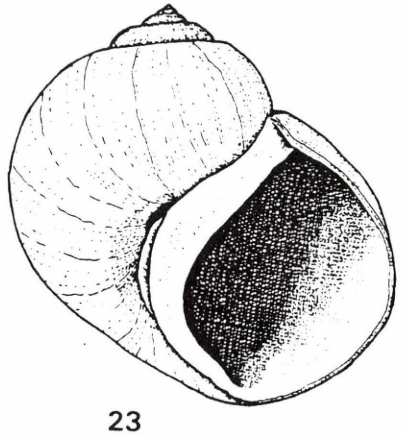

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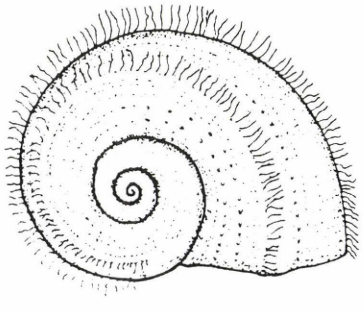

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Fig. 18. *Microcolpia acicularis*, Lajta at Mosonmagyaróvár
Fig. 19. *Esperiana esperi*, juvenil specimen, Mosoni-Duna at Dunaszeg
Fig. 20. *Bithynia tentaculata*, Lajta at Mosonmagyaróvár
Figs 21-22. *Viviparus contectus*, Lajta at Rohrau
Fig. 23. *Lithoglyphus naticoides*, Lajta at Rohrau, subfossil

Family Valvatidae

Valvata piscinalis (O. F. Müller, 1774)

Localities: Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Bruck, in secondary branches 16. 7. 1991 (A).

V. piscinalis was infrequently screened from secondary branches.

Valvata cristata O. F. Müller, 1774

Locality: Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H).

This prosobranche snail occurs in the submerged vegatation zone of deadwater reaches. It is widely spread in Central and East European lowlands (Falkner 1989).

Family Viviparidae

Viviparus contectus (Millet, 1813)

Localities: Rohrau, in secondary branches 1990, 1991 (A); Rét-árok (Leithakanal) 1987 (A/H).

The largest member of the Viviparidae family (Figs 20-21) was collected abundantly in several, slowly running branches of the Lajta. In contrast to *V. acerosus*, it prefers the stagnant water and mud bottom.

Viviparus acerosus (Bourguignat, 1862)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H).

This species is endemic to the Danube basin (Zilch & Jaeckel 1962). It is abundant throughout the whole Kisalföld and all large tributaries of the Danube, e. g. the neighbouring Rábca, Rába, Morava and Thaya rivers. In general, this *Viviparus* species is absent from the upper reaches of the Danube. Consequently, it occurs as far upstream as Vienna. Relicts of the warm, postgacial period still exist in the Bavarian reaches of the Danube (Schulte & Weinzierl 1989). *V. acerosus* does not enter the Lajta. Its occurence is restricted to the confluence with the Mosoni-Duna.

Hirudinea

Family Glossiphoniidae

Glossiphonia complanata (Linnaeus, 1758)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H); Nickelsdorf (Miklóshalma) 26. 10. 1991 (A/H); Rét-árok (Leithakanal) 11. 9. 1989, 30. 7. 1991 (A/H); Kleine Leitha (Kis-Lajta) near the Albrechtsmühle 30. 7. 1991 (A); Bruck, in secondary branches 16. 7. 1991 (A).

G. complanata has no special habitat preferences. It is a predator of small specimens of Mollusca and settles various types of permanent water bodies of lowlands as well as of the mountainous regions.

Glossiphonia verrucata (Fr. Müller, 1844)

Localities: Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H); Mosonmagyaróvár (Ungarisch-Altenburg) 3. 4. 1990 (H); Nickelsdorf (Miklóshalma) 23. 6. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A); upstream from Nickelsdorf 26. 10. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); downstream from Hollern 26. 10. 1991 (A); Bruck, in secondary branches 16. 7. 1991 (A).

This rheophilic species prefers the gravel bottoms of fast flowing rivers of the hill country (Nesemann 1990b). It is an abundant member of the fauna of the mainstream and distributed throughout all regions of the Lajta.

Glossiphonia concolor (Apáthy, 1888)

Localities: Mosonmagyaróvár (Ungarisch-Altenburg) 3. 4. 1991 (H); Rét-árok (Leithakanal) 11. 9. 1989, 30. 7. 1991 (A/H); Gattendorf (Lajtakáta), in a small pond near the river 30. 6. 1991 (A); Rohrau, in secondary branches from numerous collections 1990-1991 (A); Gerhaus 10. 5. 1991 (A); Pachfurth, in a secondary branch "Unterer Auwinkel" 2. 6. 1990 (A); Pachfurth, in small deadwater reaches 2. 6. 1991 (A); Bruck, in secondary ranches, 16. 7. 1991 (A).

G. concolor belongs to the pontomediterranean fauna. In general, its distribution pattern in the Danube basin resembles that of *Viviparus acerosus*. The north-western border of its area is in the Vienna and Kisalföld plains. The species settles abundantly the rivers and streams of the Danubian lowlands (Nesemann 1990b). In the Lajta, *G. concolor* was recorded frequently from various water bodies of the floodplain throughout the lower and middle reaches. It appears as far upstream as Götzendorf.

Glossiphonia paludosa (Carena, 1824)

Localities: Mosonmagyaróvár (Ungarisch-Altenbug) 3. 4. 1990 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 2. 1989, 9. 1991 (A/H).

G. paludosa, as well as *G. concolor*, originates from the pontomediterranean fauna. This species is strongly restricted to lowland rivers with a moderate velocity of flow. It occurs abundantly in the Pannonian reaches of the Danube, being completely absent from the upper river basin. In the Lajta, *G. paludosa* only reaches the Kisalföld, whereas the Danube is settled as far upstream as the Vienna plain.

Helobdella stagnalis (Linnaeus, 1758)

Localities: Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H); Mosonmagyaróvár Ungarisch-Altenburg 3. 4. 1990 (H); Rét-árok (Leithakanal) 11. 9. 1989, 30. 7. 1991 (A/H); Nickelsdorf (Miklóshalma) 26. 10. 1990, 23. 6. 1991 (A/H); Gattendorf 30. 6. 1991 (A); Gattendorf, in a small pond near the river 30. 6. 1991 (A); Rohrau, in secondary branches 14. 5. 1991 (A).

The distribution pattern resembles that of *Glossiphonia complanata*. *H. stagnalis* lives in all types of permanent water bodies of the floodplain of the Lajta.

Hemiclepsis marginata (O. F. Müller, 1774)

Localities: Rohrau, in a secondary branch 14. 5. 1991 (A); Bruck, in a secondary branch 16. 7. 1991 (A).

This species belongs to the fauna of secondary branches. It is a typical faunal member of slowly running rivers of the lowlands and is widely spread throughout the Danube basin.

Alboglossiphonia heteroclita (Linnaeus, 1761)

Locality: Rohrau, in a secondary branch 14. 5. 1991 (A).

A. heteroclita was collected from one locality. The distribution area includes the western Palaearctic region (Sawyer 1986). In the lowlands of the Danube, it appears frequently in all rivers.

Theromyzon tessulatum (O. F. Müller, 1774)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Rét-árok (Leithakanal) 11. 9. 1989 (A/H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 2. 1989 (A/H); Gattendorf (Lajtakáta), in a small pond near the river 30. 6. 1991 (A); Bruck, in a secondary branch 16. 7. 1991 (A).

This species sucks blood from the nose of birds. It prefers the slowly running reaches of rivers and their adjacent backwaters (Soós 1967).

Family Piscicolidae

Piscicola geometra (Linnaeus, 1758)

Localities: Nickelsdorf (Miklóshalma) 9. 1991 (A/H); upstream from Nickelsdorf 26. 10. 1990 (A); Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) 30. 7. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); Rohrau 14. 5. 1991 (A).

The fish leech is an abundant member of the fauna of the Lajta. It is distributed throughout the whole middle and lower reaches, appearing in the mainstream and in the secondary branches. The second species of this genus, *Piscicola haranti* Jarry, 1960, recently found in the Rábca and Körös, was not observed in the Lajta (Nesemann 1991a).

Family Haemopidae

Haemopis sanguisuga (Linnaeus, 1758)

Localities: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Rohrau, in secondary branch 27. 5. 1990, 14. 5. 1991 (A); Pachfurth, in a secondary branch "Unterer Auwinkel" 2. 6. 1990 (A); Pachfurth, in small, deadwater reaches 4. 1990 (A).

H. sanguisuga belongs to the semiaquatic fauna, preferring mud and sand of the banks near the water line (Nesemann 1990a). It is absent from the fast flowing reaches of the mainstream.

Family Hirudinidae

Hirudo medicinalis Linnaeus, 1758

Localities: Pachfurth, in several small deadwater reaches 4. 1990, 4. 1991 (A).

The medicinal leech feeds on higher vertebrates. It occurs in swampy, temporarily flooded ponds of lowland rivers (Nesemann 1991b). During the activity period from April to August, the leeches can be frequently found in the submerged vegetation.

Family Erpobdellidae

Erpobdella nigricollis (Brandes, 1900)

Localities: Mosoni-Duna, from two collections 1990, 1991 (H); Lajta at the confluence with the Mosoni-Duna 13. 9. 1991 (H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Rét-árok (Leithakanal) 30. 7. 1991 (A/H); Nickelsdorf (Miklóshalma) 26. 10. 1991 (A/H).

E. nigricollis belongs to the fauna of potamon rivers, being strongly restricted to the lowlands and plains. The distribution area is bordered in the Kisalföld, whereas isolated relicts still exist in the Bavarian Danube. The species inhabits the Danube as far upstream as Dunaremete. The closely settled area of the Hungarian plains includes the lower reaches of the tributaries, e. g. the Lajta and Mosoni-Duna (Soós 1963, 1967).

Erpobdella vilnensis (Liskiewicz, 1925)

Locality: Rét-árok (Leithakanal) 11. 9. 1989 (A/H).

This *Erpobdella* species prefers streams of the mountains and hilly countries. In general, it is absent from lowland rivers. Nevertheless *E. vilnensis* can occasionally be found in potamon rivers, when drifted out of smaller tributaries.

Erpobdella octoculata (Linnaeus, 1758)

Localities: Lajta at the confluence with the Mosoni-Duna 13. 9. 1991 (H); Mosonmagyaróvár (Ungarisch-Altenburg) 3. 4. 1990 (H); Rét-árok (Leithakanal) 11. 9. 1989, 30. 7. 1991 (A/H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Zurndorf (Zurány)

23. 6. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); Gattendorf, in a small pond near to the river bed 30. 6. 1991 (A); downstream from Hollern 26. 10. 1990 (A); Rohrau 14. 5. 1991 (A); Rohrau, in a secondary branch 27. 5. 1990, 14. 5. 1991 (A); Gerhaus 10. 5. 1991; Bruck, in a secondary branch 16. 7. 1991 (A).

E. octoculata is widely spread in the western Palaearctic region. This species is a generalist in its habitat preferences, occurring in all types of permanent water bodies (Soós 1967, Sawyer 1986).

Dina punctata Johansson, 1927

Localities: Mosoni-Duna near Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H); Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H); Mosonmagyaróvár (Ungarisch-Altenburg) 3. 4. 1990 (H); Rét-árok (Leithakanal) 11. 9. 1989 (A/H); Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A); Lajta-megyei-csatorna (Komitatskanal) 9. 1991 (A/H); Nickelsdorf (Miklóshalma) 26. 10. 1990, 23. 6. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); downstream from Hollern 26. 10. 1991 (A); Rohrau 14. 5. 1991 (A); Pachfurth 27. 5. 1990 (A); Gerhaus 3. 6. 1991 (A); Bruck, in a secondary branch 16. 7. 1991 (A).

This rheophilic *Dina* species originates from the upper reaches of rivers and streams as well as *Unio crassus cytherea* and *Leuciscus souffia souffia* (Risso, 1826). It is the most abundant leech of the upper Danube basin. The distribution area is extended into easterly direction as far downstream as the middle reach of the Danube (Érd-Ófalu, Dunaújváros). The Lajta is the only Hungarian tributary of the Danube, which is inhabited by *Dina punctata* (Nesemann 1990a). In the Kisalföld and Alföld plains, the species is strongly restricted to the Danube, except the Lajta.

Dina lineata lineata (O. F. Müller, 1774)

Locality: Pachfurth, in a swampy, wooded district 27. 5. 1990 (A).

D. lineata occurs in the lowlands and plains along the middle and lower reaches of the Danube. It is completely absent from the upper river basin. Its western distribution range is bordered in the Vienna and Kisalföld plains. The Danubian populations belong to the nominate subspecies *Dina lineata lineata*. They prefer swampy areas and temporarily flooded ponds, which are poor in oxygen and filled with organic matter. Therefore, *D. lineata lineata* resembles *Sphaerium nucleus* and *Segmentina nitida* (O. F. Müller, 1774) in its habitat preferences.

Crustacea

Amphipoda
Family Gammaridae

In the Lajta, the composition of gammarids is typical of most lowland rivers, flowing in the Vienna plain, the Kisalföld, and the Transdanubian hill country. *Gammarus pulex* (Linnaeus, 1758) exists only as relict populations along the upper Danube (in Bavaria and upper Austria) and is absent from the western part of the Hungarian plains. Consequently, *Gammarus roeseli* Gervais, 1835 is the dominant species in the potamon. The faunal composition of the Danube and the tributaries is very different because most of the Pontocaspian gammarids (*Dikerogammarus, Chaetogammarus, Obesogammarus*) are strongly restricted to the Danube and do not enter the adjacent waters.

Gammarus roeseli Gervais, 1835

Localities: Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H): Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Miklóshalma) 9. 1991 (A/H); Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A); Nickelsdorf (Miklóshalma) 23. 6. 1991 (A/H); Zurndorf (Zurány) 23.

6. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); Deutsch-Hasslau 6. 1991 (A); Rohrau 14. 5. 1991 (A); Gerhaus 9. 5. 1991 (A); Bruck, in a secondary branch 16. 7. 1991 (A).

This species occurs in high abundance in the whole course of the Lajta. It is the only member of the family Gammaridae, which occurs in the slowly running secondary branches. In the mainstream of the Lajta, *G. roeseli* was found sympatrically with *Gammarus fossarum* Koch, 1835. It is of South-eastern European origin (Straskraba 1958).

Gammarus fossarum Koch, 1835

Localities: Lajta at the confluence with the Mosoni-Duna 6. 9. 1991 (H); Nickelsdorf (Miklóshalma) 23. 6. 1991 (A/H); Lajta-megyei-csatorna (Komitatskanal) near Nickelsdorf (Mikóshalma) 9. 1991 (A/H); Zurndorf (Zurány) 23. 6. 1991 (A); Gattendorf (Lajtakáta) 30. 6. 1991 (A); Deutsch-Hasslau 6. 1991 (A); Rohrau 14. 5. 1991 (A); Gerhaus 9. 5. 1991 (A).

This rheophilic species mainly lives in the rhithron rivers and streams. It is also wide-spread in the larger running waters of the upper Danube basin, because of their rhithron character. *G. fossarum* is present in several of the lowland rivers of the Danube plain, which have a relatively strong current and gravel bottom (Zala, Lajta). Most slowly running rivers were not inhabited by this species (Rába, Rábca). This distribution pattern is similar to that within the Lajta floodplain. Here *G. fossarum* only settles in the main stream and does not enter the deadwater reaches (Karaman & Pinkster 1977).

Dikerogammarus haemobaphes (Eichwald, 1841)

Locality: Mosoni-Duna at Mosonmagyaróvár (Ungarisch Altenburg) 13. 9. 1991 (H).

Pontocaspian *Dikerogammarus* species are characteristic members of the Danubian fauna. Only *D. haemobaphes* is distributed widely in the upper Danube. It does not enter the tributaries of the Kisalföld. Along the Lajta, this species is restricted to the confluence with the Mosoni-Duna like *Viviparus acerosus*.

Synurella ambulans (Fr. Müller, 1846)

Locality: Rohrau, in a deadwater pond 14. 5. 1991 (A).

This amphipod is distributed in some of the tributaries of the Black and Baltic sea (Straskraba 1958). It inhabits the reed zones of lowland rivers and lakes as well as the mud and organic matter in small stagnant waters and springs (Dudich 1927). Several populations with rudimentary eyes are known to live near groundwater (Straskraba 1958). *S. ambulans* was often the only gammarid species found in ponds, which are poor in oxygen (Forró 1991). The species reaches its western distribution limit in Lajta floodplain. It is absent from the upper Danubian river basin (Straskraba 1958, Vornatscher 1965).

Decapoda

Family Astacidae

During the investigation period, crayfish were not observed in the study area on the Lajta. Entz (1909, 1914) recorded the occurrence of *Astacus leptodactylus* Eschscholz, 1851 near Mosonmagyaróvár. This species has a pontocaspian distribution (Brodski 1969, Albrecht 1983, Roth & Kinzelbach 1986) with a western border in the Kisalföld. The abundant crayfish was recently found in the main stream of the Danube throughout the Alföld plain. It still exists in the Lajta basin, where it lives in deep lakes of gravel pitches (T. Ofenböck, pers. comm.).

Bryozoa

Plumatella fungosa (Pallas, 1768)

Localities: Bruck, in secondary branches 16. 7. 1991 (A); Rohrau, in secondary branches 2. 6. 1990, 14. 5. 1991 (A).

P. fungosa is a warm stenotherm species, which settles abundantly in the lower reaches of large rivers, deadwaters and secondary branches. It is spread throughout the holarctic region (Lacourt 1968).

Plumatella emarginata Allman, 1844

Locality: Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A).

The cosmopolitan *P. emarginata* is distributed widely on all continents of the world. It occurs in eutrophic rivers and deadwaters (Lacourt 1968).

Porifera

Spongilla lacustris (Linnaeus, 1758)

Localities: Rét-árok (Leithakanal) 30. 7. 1991 (A/H); Kleine Leitha (Kis-Lajta) at the Albrechtsmühle 30. 7. 1991 (A).

This species is distributed throughout the holarctic region. It prefers stagnant or slowly running waters.

Ephydatia fluviatilis (Linnaeus, 1758)

Locality: Bruck, in secondary branches 16. 7. 1991 (A).

This cosmopolitan species lives mainly in running waters, although it also occurs abundantly in brackish waters, e. g. the Nordostsee-Kanal.

The subfossil Mollusca fauna of the lower Lajta

Since the second half of the last century, the river bed and habitat have been changed by human activities. This process is still reflected in the longitudinal zonation and the distribution patterns of several species of freshwater fauna. The importance of human interventions can be demonstrated by differences in the present day faunal composition as compared to the subfossil record. Similarly to the neighbouring Rába and Rábca rivers, the Lajta originally had a meandering river bed. It was channelized during the 19th century when the main course was radically shortened to less than a third of its former length. On the other hand, channelization created a great number of deadwater reaches and stagnant water bodies. They were formed by cutting short stretches of the river. Aside from one early paper (Clessin 1888), there is no information on faunal distribution before the channelization.

In 1991, an alluvial river bed near the castle of Rohrau was dredged. This presented an opportunity to investigate the subfossil fauna representing the former state of the Lajta. The following species were collected in high abundances: *Unio crassus cytherea, Anodonta anatina, Pisidium amnicum, Theodoxus danubialis, Theodoxus transversalis, Lithoglyphus naticoides, Microcolpia acicularis, Valvata piscinalis*. All of these species, except for *A. anatina* and *V. piscinalis*, disappeared from the middle reach of the river in the Vienna plain. Most of them, however, still survive in the Kisalföld reach. The subfossil faunal composition resembles that of the recent Lajta-megyei-csatorna and the Lajta at Mosonmagyaróvár. All of these species still exist in the Danube and the Mosoni-Duna. It appears that the main effect of the channelization was a downstream shifting of biological zonation.

Discussion

Longitudinal zonation of the Lajta-Mosoni-Duna system

The fauna of the Lajta is unique in composition as compared with other lowland tributaries of the Kisalföld. Some evidences are listed below.

- The sympatrical occurrence of Neritidae (*Theodoxus*) and Thiaridae (*Microcolpia, Esperiana*) is an attribute of Danubian fauna and was never recorded from other tributaries. Most of the Danubian prosobranche snails are restricted to short stretches near to the mouth.

- The pannonian subspecies *Unio tumidus zelebori* (Zelebor, 1851) is absent from the Lajta as well as from the upper Danubian river basin. This mussel could not enter the upper Danube since the end of Pleistocene. In contrast to the Lajta and upper Danube, it is one of the most abundant species in adjacent water systems, e. g. Rába, Rábca, Zala and Morava. The distribution pattern of *Viviparus acerosus* in the Kisalföld resembles that of *Unio tumidus*.

- The rheophilic leech *Dina punctata* allopatrically occurs instead of *Trocheta cylindrica* Örley, 1886. The latter species has a western distribution border in the Kisalföld, whereas *Dina punctata* has the eastern border of its area, which is formed just like that of the freshwater mussel *Unio crassus cytherea*.

- Two dominant members of the Lajta fauna belong to the faunal composition of gravel in fast flowing rivers. *D. punctata* and the prosobranche snail, *Theodoxus danubialis*, are as abundant in this river as in the Kisalföld reach of the Danube. There is no other river where they occur in high density.

In the main course of the Lajta, the number of species increases proportionally as one moves downstream (Fig. 24). Freshwater mussels and leeches are abundant in the area of the Kisalföld. Prosobranche snails mainly occur in the same region. The distribution area of some members of the fauna of lowland rivers borders on the lower reach: *Pisidium amnicum, Pisidium supinum, Pisidium henslowanum, Pisidium nitidum, Esperiana esperi* and *Erpobdella nigricollis.* They are restricted recently to the Kisalföld. Another group of species enters the Vienna plain and includes *Synurella ambulans, Glossiphonia concolor* and *Dina lineata*. The Lajta forms the western boundary of their distribution area.

Ecological zonation of the floodplain of the Lajta

The freshwater fauna of the investigated region can generally be divided up into four ecological groups, which are characteristic of different types of water bodies in the floodplain (Table 1). The first group contains seven species, which lives only in the main stream. These so-called Lajta species prefer gravel or hard bottom and are rheophilic. A great number of the remaining taxa belong to the stagnophilic fauna, which only occur in deadwater reaches and secondary branches. The third group, the euryoecius species, tolerate various habitats and are able to settle in different water bodies. The last group includes several members of the fauna of the middle reach of the Danube, which are strongly restricted to the Kisalföld.

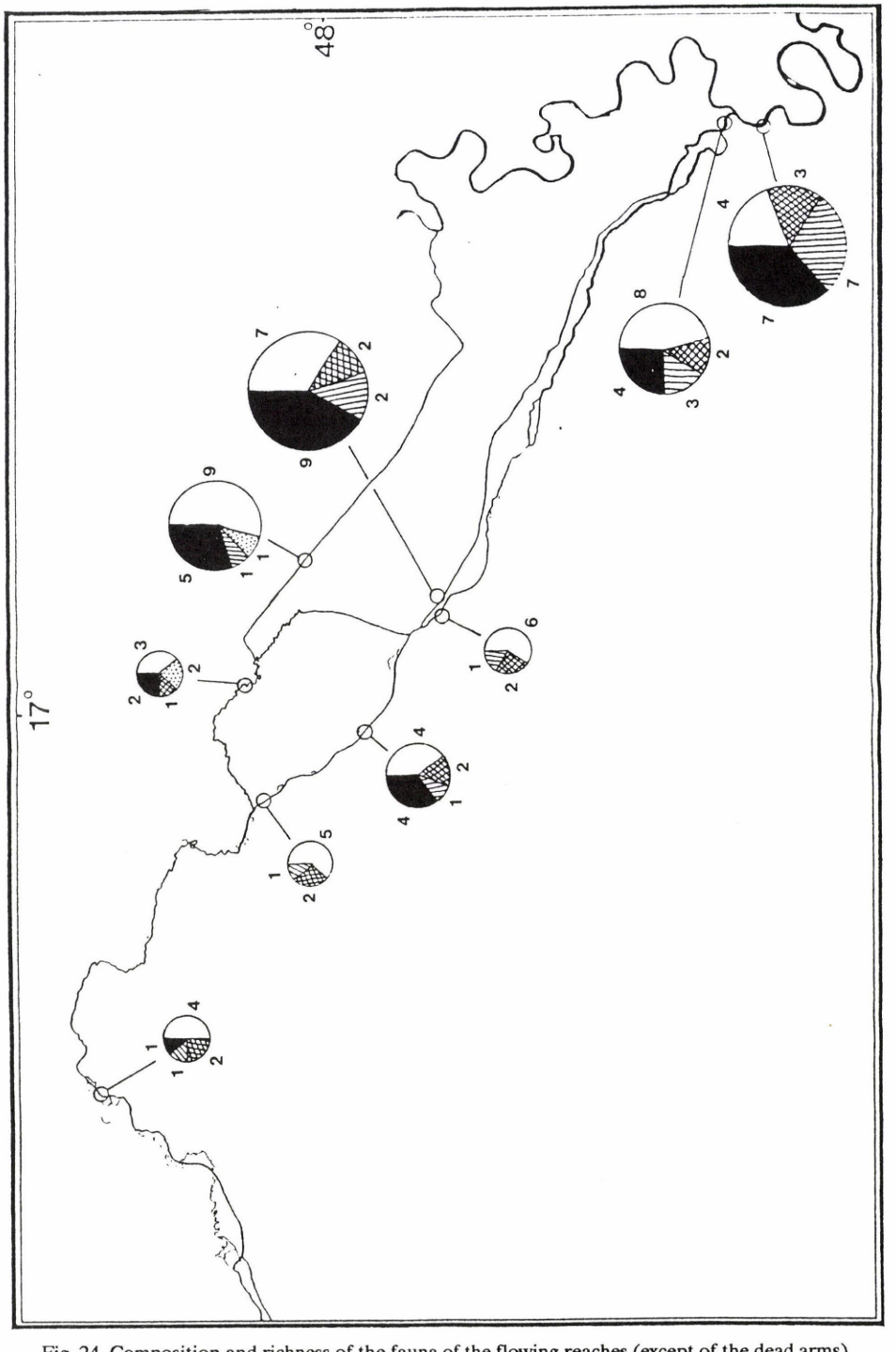

Fig. 24. Composition and richness of the fauna of the flowing reaches (except of the dead arms). Numbers indicate number of species of each group.
(Bryozoa: dotted; Amphipoda: squared; Prosobranchia: striped; Bivalvia: shaded; Hirudinea: empty)

Table 1. Ecological groups of the benthic fauna of the Lajta river

1. Species of the main stream
Sphaerium corneum
Pisidium amnicum
Unio crassus cytherea
Theodoxus danubialis
Glossiphonia verrucata
Dina punctata
Gammarus fossarum

2. Stagnophilic species of the dead arms
Sphaerium nucleus
Musculium lacustre
Pisidium obtusale
Anodonta anatina
Valvata piscinalis
Viviparus contectus
Hemiclepsis marginata
Alboglossiphonia heteroclita
Theromyzon tessulatum
Haemopis sanguisuga
Hirudo medicinalis
Dina lineata
Synurella ambulans
Plumatella fungosa
Spongilla lacustris

3. Euryoecius species of various water bodies
Pisidium subtruncatum
Pisidium personatum
Pisidium casertanum
Bithynia tentaculata
Glossiphonia complanata
Glossiphonia concolor
Helobdella stagnalis
Piscicola geometra
Erpobdella octoculata
Gammarus roeseli
Ephydatia fluviatilis

4. Species of the lower reach
Pisidium supinum
Pisidium henslowanum
Pisidium nitidum
Microcolpia acicularis
Viviparus acerosus
Glossiphonia paludosa
Erpobdella nigricollis

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